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CONTRIBUTIONS OF METACOGNITIVE SKILLS TOWARD STUDENTS' COGNITIVE ABILITIES OF BIOLOGY THROUGH THE IMPLEMENTATION OF GITTW (GROUP INVESTIGATION COMBINED WITH THINK TALK WRITE) SRATEGY

Lina Listiana[a], Herawati Susilo[b], Hadi Suwono[c], Endang Suarsini

The Faculty of Education, University of Muhammadiyah Surabaya, Jl. Sutorejo 59, Surabaya, Indonesia.
Biology Education Courses, Pascasarjana UM Malang, Jl. Semarang 5 Malang

Corresponding e-mail: linahamdani22@yahoo.com, fds herawati_susilo@yahoo.com;hadisuwonodr@gmail.com; suarsini2001@yahoo.com.

Abstract: Metacognitive skill is an important aspect that must be developed and empowered in learning activities because it helps the development of thinking skills as well as its implications on students' cognitive abilities. Therefore, the learning process should be designed to empowered metacognitive skills. This is a correlational study which aims to find (1) the relationship of metacognitive skills with cognitive abilities of Biology, and (2) the contribution of metacognitive skills on cognitive abilities of Biology on the application of the *GI*, *TTW* and *GITTW* strategies. The population of this study is Muhammadiyah high school students of grade 10th at Surabaya in the 1st academic year 2014/2015 in the science major. Samples were students of grade 10th which consists of six classes determined by random sampling. Data had been collected by conducting pre-test and posttest during the learning process for one semester. Learning instruments used in this study are syllabus, lesson plan (RPP), and students' worksheet (LKS). All learning devices are using *GI*, *TTW* and *GITTW* strategies. The forms of instruments used are an essay test and cognitive skills rubrics. Metacognitive skills had been measured by metacognitive rubric integrated with cognitive ability test. Data was analysed by correlation and regression techniques. The results of the study showed that there were a significant correlation between metacognitive skills with cognitive abilities of Biology in *GI* strategy with a correlation coefficient (r) of 0.906, the *TTW* strategies correlation coefficient (r) of 0.951 and the strategies *GITTW* correlation coefficient (r) of 0.881. Metacognitive skill level of contribution to the cognitive abilities of Biology at *GI* strategy is 82%, the *TTW* strategy is 90.5%, and the *GITTW strategy* is 77.7%.

Keywords: *Metacognitive skills, Cognitive abilities of Biology, GITTW Strategy (Group Investigation combined with Think Talk Write)*

1 INTRODUCTION

Facing the challenges of modern life in the 21st century is very concerned with preparing qualified human resources (HR). Qualified human resources resulting from a qualified academic process. However, it is the fact that the education in Indonesia has not fully produce the qualified human resources. The survey results of the United Nation Development Program (UNDP) in 2013 stated that the Indonesian Human Development Index (HDI) was ranked in 121 out of 187 countries in the world. It means that the quality of our education is still low.

One of the causes of low quality of education in Indonesia compared to other countries is lack of empowerment of students' thinking skills for learning (Corebima, 2010). Ability and thinking skills are important aspects that must be developed in learning Biology. According Listiana (2013) efforts to improve thinking skills in the Biological learning process is still far from the expectation. This happens because the teachers' understanding of the nature of thinking skills not yet mastered, so that when the teachers design the learning activities that can empower thinking skills are still not optimal.

Slavin (2000) says that thinking and learning skills are samples of metacognition skills. Through metacognition skills students can learn to think about their own thinking

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processes and implement strategies to learn to think for themselves through a difficult task. Livingston (1997) says that metacognitive skills hold a critical role (very important) for the successful learning. Based on the above opinions, metacognitive skills need to be developed and empowered in learning activities since by using metacognitive skills students can evaluate their own learning ways.

The success of learning can be seen through the learning outcomes. Students' learning outcomes is closely related to the students' independence in learning and the independence is related to metacognitive skills. Moreover, it is revealed that students who have metacognitive skills have a great chance to be independent learners (Peters, 2000). In accordance with Susantini's opinions (2004), by metacognitive students will be independent learners, foster honest attitude, daring to admit mistakes and improve learning outcomes significantly. There is a relationship between metacognitive skills and students' cognitive abilities. Coutinho research results (2007) indicate that there is a positive relationship between learning achievement with metacognition. Students who have good metacognitive skills will show good performance compared with students who have low metacognitive skills.

Facts related to the empowerment of metacognitive skills in the learning of biology showed that in several Muhammadiyah high schools in Surabaya that only 30% of teachers who seek to empower students' metacognitive skill; there are even teachers who still do not understand about metacognitive skills. Conventional learning strategies such as lecturing, discussion, question and answer and doing exercises are still largely dominate the learning patterns of biology. In addition, the average scores of biology is only 70. It can only be considered as fair (Listiana, 2014). The learning outcome of biology is an indicator of the learning success which is determined by the use of strategies that can push the empowerment of thinking skills and as the result increase students' cognitive abilities.

To encounter this fact, it needs some efforts to develop and empower metacognitive skills so that it will have an impact on improving the students' cognitive abilities. It can be applied by using learning strategies to encourage students to empower their metacognitive skills. This is reinforced by research conducted by Singh (2012), Basith (2010), and Zein (2010), which shows the relationship metacognitive skills with learning outcomes in a variety of learning strategies applied.

Learning strategy which is believed can develop and empower thinking and metacognitive skills is Group Investigation (GI) strategy. The use of *GI* strategy has revealed some advantages such as the students (a) are directly involved in acquiring the knowledge; (b) are not just as a recipient; (c) develop interpersonal intelligence; (d) create knowledge and develop higher thinking skills; (e) learning more information that a higher level when learning in cooperative groups; (f) are encouraged to achieve higher-level thinking on learning (Mitchell et al., 2008: 389). Several studies have shown that the *GI* has a potential to improve thinking skills and scientific attitude (Nasrudin & Azizah, 2010). Danial (2010) says that *GI* influences metacognitive skills and understanding of the students' concept. Akcay and Doymus (2012) and Tan et al. (2007) state that there are differences in learning outcomes between *GI* and the control group.

Other learning strategy which is expected to develop and empower metacognitive skill is *Think Talk Write* (*TTW*) strategy. It is introduced by Huinker and Laughlin (1996) which is easy to be adapted to the changing conditions and can be applied to all areas of study at various levels, with a very simple syntax (Ansari, 2004). Results of the study revealed that *TTW* strategy can enhance the activities and learning outcomes of Biology (Solikhah, 2009 and Astohar, 2010). *TTW* is a strategy that is built through thinking, talking and writing (Huigher and Laughlin, 1996). The activity of thinking, talking and writing are learning activities that give students opportunities to empower metacognitive skills.

GITTW strategy is a blended strategy between *GI* and *TTW* which is packaged in the form of cooperative learning. It is a new strategy that is believed can develop and empower metacognitive skills that will impact on the increasing students' cognitive abilities.

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This mixed strategy departs from the limitations of *GI* and *TTW*. Both of these strategies combined by way of *TTW* syntax is integrated at every stage in the *GI*. This strategy trains students to investigate a real topic or theoretical problem, access information from various sources, observe, analyze, synthesize, present and evaluate them through the process of thinking, talking and writing. Based on these conditions, the study is conducted to determine whether there is a relationship between metacognitive skills and students' cognitive abilities on the application of the *GI*, *TTW* and *GITTW*.

2 METHOD

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.906[a]	.820	.816	4.63000

a. Predictors: (Constant), *KetMetaGI*

This study is correlational which aims to find (1) the relationship of metacognitive skills with cognitive abilities of biology, and (2) the contribution of metacognitive skills on cognitive abilities of Biology on the application of the *GI*, *TTW* and *GITTW* strategies. The design of the study is using the group design of pretest-posttest control group designs (Fraenkel & Wallen, 2009) consisting of three groups; (1) class with *GI* strategy, (2) class with *TTW* strategy, and (3) class with *GITTW* strategy. Each treatment consists of two classes. Data collection is done by administering a pretest and posttest. Questions used during the pretest and posttest are similar which consists of 8 number in the form of essay. Metacognitive skills tests are conducted by the integration of questions of cognitive ability of biology (Corebima, 2008). The materials taught are all the contents of Biology in grade X semester 1.

The population of the study is all students of Muhammadiyah senior high schools in Surabaya of tenth grade in science major in the 1st half academic year 2014/2015. It consists of 6 School with the total fifteen science classes. The sample of the study were students of grade X semester 1 which consists of six classes. Selection of sample classes was conducted by random sampling.

The instruments used are syllabuses, Lesson Plan (RPP), and the Students Worksheet (LKS). All of those instruments are arranged by using the patterns of *GI*, *TTW* and *GITTW* strategies. Measuring instrument consists of a test item, cognitive abilities and metacognitive skills rubric. The questions of the tests used have been validated in the aspects of contents, construction, empiric, test reliability, the level of difficulty and difference with the results which have good categories. Metacognitive skills rubric used is developed by Corebima (2008). Data were analyzed using correlation analysis technique regression with SPSS 18 for windows.

3 RESULT AND DISCUSSION

3.1 Results of the Study

Before the data were analyzed, it first tested by *One-Sample Kolmogorov- Smirnov* to determine the normality of the data distribution. Based on the data normality test of each learning strategy, the data increase metacognitive skills and cognitive abilities in each learning strategy was normally distributed. The next is the test of correlation significance and regression analysis.

GI Strategy

Summary of regression analysis of the relationship of metacognitive skills with students' cognitive abilities on the application of *GI* strategy can be seen in Table 1 to 3.

Tabel 1. Summary of regression analysis of the relationship of metacognitive skills with students' cognitive abilities on the application of *GI* strategy.
Tabel 2. Summary of Anova on the relationship of metacognitive skills with students' cognitive abilities on the application of *GI* strategy.

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3907.624	1	3907.624	182.285	.000[a]
	Residual	857.477	40	21.437		
	Total	4765.101	41			

a.Predictors:(Constant),KetMet
b.DependentVariable:HBKog*G*

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Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.951[a]	.905	.902	4.11976

Predictors:(Constant), *KetMetaTTW*

Tabel 3. Regression Coefficient on the relationship of metacognitive skills with students' cognitive abilities on the application of *GI* strategy

Coefficients[a]

Model		Unstandardized Coefficients		Standardize Coefficient		
		B	Std. rror	Beta	t	Sig.
1	Constant)	5.174	1.514		3.418	.001
	KetMeta GI	1.147	.085	.906	13.501	.000

a. Dependent Variable: HBKog*GI*

Based on the analysis of data, the F value of 182.285 with a significance value is 0.000 <0.05 which means that there is a relationship between metacognitive skills with students' cognitive abilities on the application of the *GI* strategy. The regression equation based on the results of the data analysis is y = 1,147x + 5.174 with the reliability value of 0.820 which means metacognitive skills contribute to cognitive ability of 82%, while 18% is other factor besides metacognitive skills. Graph relationship between metacognitive skills with students' cognitive abilities on the application of the *GI* strategy can be seen in Figure 1.

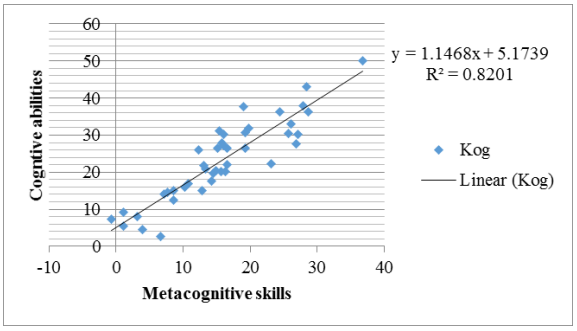

Figure 1. The relationship of metacognitive skills with students' cognitive abilities on the learning of Biology using *GI* strategy.

TTW Strategy

Summary of regression analysis on relationship of metacognitive skills with cognitive abilities of *TTW* strategy can be seen in the following Table 4 to 6.

Tabel 4. Summary of regression analysis on relationship of metacognitive skills with cognitive abilities of *TTW* strategy.

Tabel 5. Summary of Anova analysis on relationship of metacognitive skills with cognitive abilities of *TTW* strategy.

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5474.274	1	5474.274	322.540	.000[a]
	Residual	577.062	34	16.972		
	Total	6051.336	35			

a.Predictors:(Constant),KetMet
b. Dep.variable:*HBKgTTW*

Tabel 6. Regression coefficient on the relationship of metacognitive skills with cognitive abilities of *TTW* strategy.

Coefficients[a]

Model		Unstandardized Coefficients		Standardize Coefficient		
			Std.Err	Beta	t	Sig.
1	Constnt	3.296	1.649		1.999	.054
	KetMet *TTW*	1.188	.066	.951	17.959	.000

a. Dependent Variable: HBKog*TTW*

Based on the analysis of data, the F value of 322.540 with a significance value relationship of metacognitive skills and cognitive abilities is 0.000 <0.05. which means that there is a relationship between metacognitive skills with students' cognitive abilities on the implementation of *TTW* strategy. The regression equation based on the results of the data analysis is y = 1,188x + 3.296 with the reliability value of 0.905 means metacognitive skills contribute to cognitive ability of 90.5%, while 9.5% are other factors besides metacognitive skills. Graph relationship of metacognitive skills with

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cognitive ability in the application of *TTW* strategy can be seen in Figure 2.

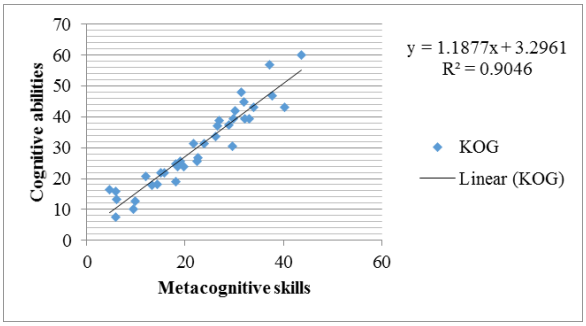

Figure 2. The relationship of metacognitive skills with cognitive ability on the learning of Biology using *TTW* strategy.

GITTW Strategy

Summary of regression on the relationship of metacognitive skills with cognitive abilities of *GITTW* strategy can be seen on Table 7 to 9.

Tabel 7. Summary of regression on the relationship of metacognitive skills with cognitive abilities of *GITTW* strategy.

Tabel 8. Summary of Anova on the relationship of metacognitive skills with cognitive abilities of *GITTW* strategy.

ANOVA[b]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6255.021	1	6255.021	139.137	.000[a]
	Residual	1798.236	40	44.956		
	Total	8053.257	41			

a.Predictors:(Constant),KetMet
b.DependentVariable:*HBKog GITTW*

Tabel 9. Regression Coefficients on the relationship of metacognitive skills with cognitive abilities of *GITTW* strategy.

Coefficients[a]

Model		Unstandardized Coefficients		Standardize Coefficient	t	Sig.
		B	Std. rror	Beta		
1	Constant)	.530	2.906		.182	.856
	KetMet GITTW	1.284	.109	.881	11.796	.000

a. Dependent Variable: *HBKogGITTW*

Based on the analysis of data, the F value of 139.137 with a significance value relationship of metacognitive skills and cognitive abilities is 0.000 <0.05. which means that there is a relationship between metacognitive skills with students' cognitive abilities on the application *GITTW* strategy. The regression equation based on the results of the data analysis is y = 1,284x + 0.530 with the reliability value of 0.777 which means metacognitive skills contribute to cognitive ability is 77.7%, while 22.3% are other factors besides metacognitive skills. Graph relationship metacognitive skills with cognitive ability in *GITTW* strategy can be seen in Figure 3 below

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.881[a]	.777	.771	6.70492

Predictors:(Constant), *KetMetaGITTW*

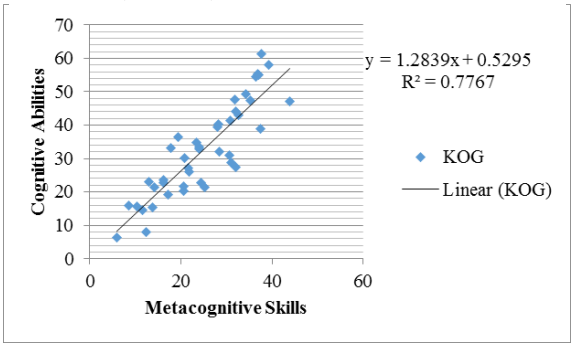

Figure 3. The relationship of metacognitive skills with cognitive abilities on the learning of Biology using *GITTW* strategy.

The regression equation line of metacognitive skills with cognitive abilities on *GI, TTW,* and *GITTW* strategy can be seen in Figure 4 below.

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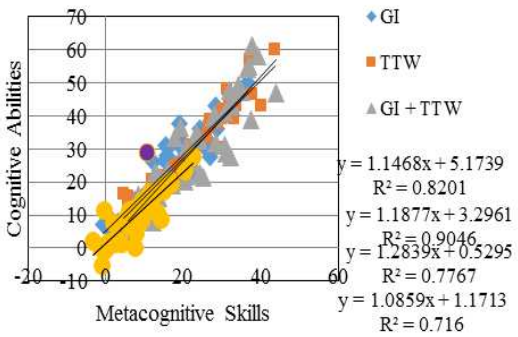

Figure 4. The regression equation line of metacognitive skills with cognitive abilities on *GI, TTW,* dan *GITTW* strategy.

In the Figure 4 shows that the regression line of the three learning strategies shows parallels and not coincide. Moreover, it appears that the relationship between metacognitive skills and cognitive ability is highest in *GITTW* learning strategy with a regression coefficient of 1.284.

3.2 Discussion

Based on statistical test, the results showed that there is a relationship of metacognitive skills with students' cognitive abilities in the application of the *GI*, *TTW*, and *GITTW* strategies. This is reinforced by several studies by Coutinho (2007), Bahri (2010), and Ardila (2013) who suggest a link of metacognitive skills on cognitive abilities with a variety of learning strategies applied. Metacognitive skills can develop the thinking skills which later impact on on students' cognitive abilities. As stated by Livingston (1997) metacognitive skills hold a critical role (very important) for successful learning.

Metacognitive skill is a process of knowing and monitoring the process of thinking or cognitive processes themselves (Arends, 1998). Metacognitive has an important role in regulating and controlling cognitive processes in learning and thinking, so it is easier to understand the duties and conduct an investigation into the matter. Students who have high metacognitive skills will seek to understand and conduct an investigation to accomplish their tasks and will monitor their own learning progress so that it affects their cognitive abilities. Along with Peters' opinion (2000) states that metacognition refers to the skills of learners aware of and monitor the learning process. Opinions Coutinho (2007), that the students who have good metacognitive skills will show good performance compared with those who have low metacognitive skills.

The results that showed metacognitive skills contribute to the cognitive abilities in the application of *GI*, *TTW*, and *GITTW* strategies are quite high. The contribution of metacognitive skills on cognitive abilities in *GI* strategy is 82%. This is due to the fact that learning using *GI* strategy is in line with metacognitive activity in which students in the group are asked to identify the selected topics, and then plan the tasks to conduct further investigation presenting the final result as the solution to the problems. These activities can encourage their metacognitive skills empower. According to Howard (2004), metacognitive skills play an important role in many types of cognitive activities including comprehension, communication, attention, memory, and problem solving. In line with the Danial (2010) reports that the *GI* strategy can enhance metacognitive skills and understanding of the concept.

The contribution of metacognitive skills on cognitive abilities on *TTW* strategy is very high, namely 90.5%. This is due to the syntax of *TTW* strategy is easier in the learning application and accompanied by a more effective syntax. Some research reported by Ansari (2004), Hidayat (2012), Supriyono (2011), Fatmawati (2011), Zulkarnaini (2011), stated that *TTW* strategy can increase understanding and mathematical communi-cation, critical dan creative thinking abilities, mathematical communication, learning activities biology, and writing skills. Activities of thinking, talking, and writing according DePorter (1992) in *TTW* learning empower students to understand the problem, then actively involved in group discussion and wrote down the results of their learning outcomes. All of these activities have the potential to increase the empowerment of metacognitive skills.

The contribution of metacognitive skills on cognitive abilities on *GITTW* strategy is very high, namely 77.7%. *GITTW* is a complex blended strategy to be applied in the learning. There was a problem in its application such as

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a long period. However, this strategy with its blended syntaxs has a high potential in improving metacognitive skills which impact on the improving cognitive abilities

Other research finding is that all those three learning strategies indicate an alignment or consistency in terms of the relationship of metacognitive skills toward cognitive abilities. This is due to the syntax of learning strategis applied which can be implemented properly and smoothly supported with adequate learning facilities. On the other hands, habituation of empowering metacognitive skills during the learning process of biology which lasts in a long time (one semester) make students become trained to regulate and control how to learn and think through integrated activities on the syntaxs of each learning strategy.

Seeing that tremendous contribution of metacognitive skills on cognitive abilities with the application of these three strategies, it is expected that teachers can implement *GI*, *TTW* and *GITTW* strategies in biology learning since these strategies do not only improve metacognitive skills but also empower the thinking ability which influence on students' cognitive abilities.

4 CONCLUSION

Based on the findings, it can be concluded that there is a relationship between metacognitive skills and cognitive abilities of tenth grade students in biology learning on the application of the *GI*, *TTW*, and *GITTW* strategies in Muhammadiyah High Schools in Surabaya. The contribution of metacognitive skills on cognitive abilities in the application of the *GI* strategy is 82%, *TTW* strategy is 90.5%, and *GITTW* strategy is 77.7%.

Suggested: (1) *GITTW* strategy can be used by teachers as one of the development of cooperative learning strategies that are able to empower metacognitive skills and cognitive abilities students, (2) *GI* and *TTW* strategy that continues to be applied and developed in learning to improve metacognitive skills and cognitive abilities of students

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